RUSTICA

Demonstration of circular bio-based fertilisers and implementation of optimized fertiliser strategies and value chains in rural communities

Deliverable 2.7:
Public cross-visit report

Project acronym	RUSTICA
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Summary

The main strategic objective of task 2.5 in WP2 is to ensure successful collaboration within and between each region by bringing in, through a multi-actor (MA) approach, a wide network of relevant actors to contribute to the project actions and to anchor project results.

Deliverable 2.7 “Public cross-visit report” describes the lessons learnt from the organised cross-visits.

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The RUSTICA Consortium

The RUSTICA consortium, which is composed of university researchers, academia, consultants, scientists, businesses, and farmers, is working together to achieve the project's common objective while stimulating an environment where each consortium partner shares and exchanges experiences to achieve the goals set-forth.

Table 1 - RUSTICA Consortium

Logo	Name	Short name	Country
KU LEUVEN	Catholic University of Leuven	KU Leuven	Belgium
DRANCO	DRANCO NV	DRANCO	Belgium
AGRICULTURES & TERRITOIRES CHAMBRE D'AGRICULTURE PAYS DE LA LOIRE	Chambre Régionale d'Agriculture des Pays de la Loire	CRAPDL	France
BioSabor	BioSabor, S.A.T.	BioSabor	Spain
crea Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria	Consiglio per la Ricerca in Agricoltura e l'Analisi dell'Economia Agraria	CREA	Italy
tecnova CENTRO TECNOLÓGICO	Fundacion para las Tecnologias Auxiliares de la Agricultura	TECNOVA	Spain
Avecom Bioproducts & Apps	Avecom NV	AVECOM	Belgium
entomo agroindustrial	Entomo Consulting S.L.	ENTOMO	Spain
particula group	Particula Group d.o.o.	PAR	Croatia
Wiedemann GmbH Bio-based Advancement	Wiedemann GmbH	WIED	Germany
ID consortium Just research it!	IDConsortium SL	IDC	Spain
crop eye	Stichting CropEye	CROPEYE	Netherlands
ILVO	Eigen Vermogen van het Instituut voor Landbouw, Visserij en Voedingsonderzoek	EV ILVO	Belgium
TNO innovation for life	The Netherland's Organisation of Applied Scientific Research	TNO	Netherlands

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UNIVERSITEIT GENT	Universiteit Gent	UGent	Belgium
CIAT	Centro Internacional de Agricultura Tropical	CIAT	Colombia

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Abbreviations

CAP	Carboxylic Acid Platform
CIAL-CSIC	Institute of Food Science Research
D	Deliverable
EU	European Union
FPCM	Madrid Science Park Foundation
LCA	Life Cycle Analysis
MA	Multi-Actor
PDO	Protected designations of origin
RBBF	RUSTICA bio-based fertiliser
SLCA	Social Life Cycle Analysis
TRL	Technology Readiness Level
WP	Work Package

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Project Abstract

The RUSTICA project provides a technical solution to convert organic residues from the fruit and vegetable sector into novel bio-based fertiliser products of high quality that address the needs of modern (organic) agriculture. The project's ambition goes beyond the simple recovery of nutrients and includes the development of economically viable and environmentally sustainable alternatives to mineral fertilisers with the same or improved agronomic value. The technical solution consists of 5 conversion processes (carboxylic acid platform, microbial biomass production, electrodialysis, insect breeding and biochar production) which can be combined depending on the available waste streams and integrated with state-of-the-art technologies such as composting. Synergies between the individual conversion processes will be sought and optimised to maximise economic and environmental benefits, and the processes will be demonstrated at TRL7. The resulting ingredients (microbial biomass, mineral nutrient concentrates, insect biomass, insect frass, biochar) will be combined to obtain tailor made fertiliser products adapted to specific crop needs. Parallel with this technological innovation and integration, a multi-actor approach guarantees the implementation potential of the technologies in the agro-food chain and will lead to sound business models. Several non-technical aspects (environmental and social LCA, legal framework, expected market developments...) will be evaluated in 4 European regions and 1 region in Colombia. Stakeholder involvement at each step guarantees the development of marketable end products for the fruit and vegetable sector, with a high replication potential to other agricultural sectors. Cooperation with other EU funded projects working on nutrient recovery from other waste products will stimulate a joint solution to evolve towards a sustainable and circular fertiliser management to close nutrient cycles within and between regions.

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Introduction

RUSTICA aims to foster the technical validation, demonstration and implementation of bio-based fertiliser and soil improvement production techniques focusing on waste from the fruit and vegetable agro-food system to close nutrient cycles on a regional level. Additionally, the project wants to bridge the gap between the nutrient losses in the form of agricultural residues and the nutrient imports in Europe by integrating and demonstrating 6 complementary technologies with high nutrient recovery potential to treat residues from the fruit and vegetable sector and turn them into a variety of fertiliser ingredients which will be formulated in tailor- made soil amendments and high effective fertilisers, with the aim to replace 5-10% of mineral fertiliser with bio-based alternatives by 2040.

The main strategic objective of task 2.5 in WP2 is to ensure successful collaboration within and between each region by bringing in, through a multi-actor (MA) approach, a wide network of relevant actors to contribute to the project actions and to anchor project results.

The specific objectives of the task are:

1. to enable the sharing of information and best practices between the regions;
2. to facilitate the replicability of RUSTICA results and approaches through cross-regional exchange.

These objectives were achieved by implementing different cross-visits to each of the RUSTICA regions. The visits were conducted by knowledge brokers and relevant stakeholders in each region.

Deliverable 2.5 “Cross-visit plans and timings” described the planned cross-visits to the different regions and the preliminary agendas for the activities.

The conclusions of these cross-visits are presented in this deliverable 2.7, “Public Cross-Visit Report.” This deliverable is structured as follows:

1. A summary of the activities conducted during each cross-visit;
2. Conclusions of Task 2.5 and lessons learned.

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1. Summary of the activities conducted during each cross-visit

The following tables summarise the activities implemented in each cross-visit and the main conclusions:

Table 2 - Valle del Cauca (Colombia), cross-visit summary

Region	Valle del Cauca, Colombia (Responsible partner: CIAT)
Date and duration	20th April 2023
Implemented activities	The cross-visit was combined with the International Stakeholder Workshop. A limited EU delegation of stakeholders traveled to Colombia to participate in the workshop and the cross-visit. The visits implemented were: • An industrial composting plant of the Providencia sugar mill, located in the municipality of El Cerrito, Valle del Cauca, where they make compost using all the by-products of the sugar mill's agro-industrial process. • Rancho Alegre farm of the Proacol company, located in the municipality of Calima el Darien, Valle del Cauca. On this farm they grow bananas and avocados, which they fertilise with poultry manure (from their own poultry production), which is composted, and they also apply efficient microorganisms. • Composting plant of the micro-enterprise HUAO SAS, in Yumbo. They compost agro-industrial waste from fruit pulp packing plants and pruning waste; they also have worm castings and vermicompost.
List of attendants	Link in the website.
Main conclusions	The RUSTICA global workshop in Palmira, Colombia, highlighted a strong willingness among Latin American experts to share experiences and take action towards circular food systems. Key barriers identified included insufficient legislation, the need for financial support to accelerate the transition to a circular bioeconomy, and the need for scientific evidence to support the replacement of synthetic fertilisers with bio-based alternatives. Issues related to waste collection systems and certification processes were also recognised as significant challenges. During the cross-visits, practical experiences in transforming agricultural residues into bio-based fertilisers were observed, such as composting sugarcane waste and implementing organic practices in avocado and banana farming. These initiatives demonstrated the potential for adapting business models developed in Europe to Latin American contexts. The workshop concluded that international collaboration could help overcome technological, social, and political barriers through project funding, strengthening multi-actor networks, and creating open platforms for technology transfer and the development of long-term public policies.
Link to website publication	https://rusticaproject.eu/second-rustica-international-workshop-cali-colombia/

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Table 3 - Flanders (Belgium), cross-visit summary

Region	Flanders, Belgium (Responsible partner: EV ILVO)
Date and duration	06th May 2023
Implemented activities	Pilot visits to ALLGRO, AVECOM and Capture.
List of entities attending	- Flanders Research Institute for Agriculture, Fisheries and Food - Katholieke Universiteit Leuven - Dranco - Anaerobic Digestion Technology - Avecom - Microbial Resource Management - Provincial Research Centre for Vegetable Production - ProteinFarm - Insect Protein Production - VITO - Flemish Institute for Technological Research - Chambre d'Agriculture Pays de la Loire - Council for Agricultural Research and Economics - Università degli Studi di Udine - Regione Autonoma Friuli Venezia Giulia - Fertira - Nutricorp - Grupo Inesta - Biosabor - Centro Tecnológico Tecnova
Main conclusions	The cross-visits to pilot sites, including ALLGRO, AVECOM, and Capture, provided valuable insights into the practical challenges and opportunities of implementing bio-based fertiliser technologies. One key takeaway was the importance of integrating multiple technologies, such as CAP, composting, and insect-based solutions, to create viable blends. However, the visits revealed that biochar production often requires distinct, specialised facilities, posing a logistical challenge for seamless integration. The cross-visits also highlighted regional differences in infrastructure and stakeholder readiness, emphasising the need for tailored approaches depending on local capacities and available technologies. Engaging with companies that are already experimenting with these technologies is crucial to accelerating adoption. Additionally, the interaction with stakeholders during the visits underscored the importance of collaboration and knowledge sharing across regions to overcome barriers and identify best practices. These visits reinforced the need to maintain active networks and ensure continued engagement to support the implementation of the RUSTICA project's objective
Link to website publication	https://rusticaproject.eu/flanders-4th-stakeholder-workshop-sustainable-agriculture/

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Table 4 - Friuli-Venezia Giulia (Italy), cross-visit summary

Region	Friuli-Venezia Giulia, Italy (Responsible partner: CREA)
Date and duration	29th of May to 2nd of June 2023
Implemented activities	The Cross-visit in Friuli Venezia Giulia involved the group in a field visit (Specogna Winery) and a composting plant (Isontina Ambiente): 1) Visit to Specogna Winery: The wine maker first presented the main features of the winery and then dwelt on the sustainable techniques adopted: - Certified organic management with minimum use of organic phytosanitary products; - Phytosanitary management based on forecasting models and monitoring by intervention thresholds; - Conservative soil management with green manuring, minimum tillage, targeted sowing and controlled management of spontaneous grassing; - Targeted organic fertilisation with soil amendments; - Grape production limited well below the maximum limits allowed by PDO quality assurance schemes; - Conservation of slope morphology by planting arboreal essences different from vines (olive, cherry); - Utilisation of renewable energy (photovoltaic) Participants had the opportunity to visit the vineyards and winery being able to appreciate the farm's products. 2) Isontina Ambiente composting plant (an intermunicipal waste management company, located and operating in the province of Gorizia): The plant is allowed to treat up to 18,000 tons of organic wastes yearly. The main treated wastes are the separate organic fraction of household waste and the wastes from private and public green care (grasses, leaves and branches). The wastes are treated by aerobic composting process carried out in biocells. The whole process is performed indoors, and the gases evolved during the process are passed through biofilters to abate odours and noxious substances. The end product of the process is a soil amendment allowed in organic farming utilised mainly in viticulture but also by citizens.
List of entities attending	RUSTICA Partners
Main conclusions	Kicking off with a warm welcome from the knowledge brokers, the workshop delved into updates on significant initiatives of the RUSTICA Project. These updates spotlighted technological advancements and progress made in pilot plant operations, setting a promising tone for the discussions ahead. Complementary projects like the Black to the Future Project and SMS Green Project were also highlighted for their innovative contributions to the bioeconomy sector. A pivotal moment of the workshop centered around the business model update, where stakeholders engaged in exploring potential scenarios and strategising for future developments. The exchange of ideas and perspectives during this session culminated in robust discussions, reflecting a collective commitment towards shaping Friuli-Venezia Giulia's business model to align with sustainable practices.

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	Participant feedback, gathered through a comprehensive questionnaire, provided invaluable insights for charting the course of future endeavors. The collaborative spirit exhibited throughout the workshop underscored a shared vision among stakeholders for fostering a more sustainable agricultural ecosystem in the region.
Link to website publication	https://rusticaproject.eu/flanders-4th-stakeholder-workshop-sustainable-agriculture/

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Table 5 - Madrid (Spain), cross-visit summary

Region	Madrid, Spain (Responsible partner: IDC)
Date and duration	12th October 2023
Implemented activities	1) CIAL: Visit to semi-industrial super critical extraction pilot plant, a metabolomics platform and a human gastrointestin simulator 2) Networking session at Parque Cientifico de Madrid - Introduction of Parque Científico of Madrid (by David Arbelo, director of technology transfer). - Short introduction of RUSTICA project (by Dr. Tessa Avermaete- RUSTICA Coordinator) - Presentation by Drage&Mate (On line) - Presentation by Biovegen - Presentation by Ekonoke - Presentation by IDConsortium on European and international project collaboration opportunities.
List of entities attending	- RUSTICA Partners - Drage&Mate - Biovegen - Ekonoke - CIAL- CSIC- UAM - Parque Cientifico de Madrid
Main conclusions	During the visit to the Institute of Food Science Research (CIAL-CSIC), RUSTICA consortium members explored advanced research facilities, including a semi-industrial supercritical extraction plant, a metabolomics platform, and a human gastrointestinal simulator. These technologies provided crucial insights for developing sustainable bio-based fertilisers. The supercritical extraction plant demonstrated efficient and eco-friendly methods for extracting bioactive compounds, aligning with RUSTICA's sustainability goals. The metabolomics platform offered tools to study metabolites at a molecular level, and the gastrointestinal simulator enabled the evaluation of nutrient release and absorption, supporting the formulation of effective fertilisers. At the Madrid Science Park Foundation (FPCM), the consortium engaged with innovative Spanish companies such as Drage&Mate, BIOVEGEN, and Ekonoke, identifying synergies that could advance the RUSTICA project. Drage&Mate's expertise in sustainable chemical processes complements RUSTICA's waste-to-fertiliser goals by offering clean energy solutions. BIOVEGEN's role in promoting plant innovation and facilitating technology transfer supports the adoption of bio-based fertilisers in the agricultural sector. Ekonoke's focus on sustainable vertical farming techniques offers valuable insights into integrating advanced technologies for resilient crop production. These interactions highlighted the importance of interdisciplinary collaboration and knowledge transfer to develop integrated and sustainable agricultural solutions.
Link to website publication	https://rusticaproject.eu/rustica-conducts-new-cross-visits-madrid/

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Table 6 - Pays de la Loire (France), cross-visit summary

Region	Pays de la Loire, France (Responsible partner: CRAPDL)
Date and Duration	29th of May 2024, organised during the partner meeting in Angers
Implemented activities	The event began with a warm welcome and an introduction to the RUSTICA project, followed by a keynote speech delivered by the president of the Chamber of Agriculture (Department 49). Participants then engaged in a networking cocktail and lunch, facilitating exchanges between regional stakeholders and RUSTICA partners. This session provided a platform for relationship-building and knowledge sharing. Subsequently, presentations were delivered on the following topics: - Overview of the regional stakeholders group and its contributions to the project. - Detailed explanation of the project Work Packages (WPs), highlighting key objectives and milestones. - Insights into the project's technologies, core components (building blocks), fertiliser solutions, and project timeline. - Updates on field trials conducted in France and other regions, showcasing real-world applications and progress. An interactive session featured interviews with three regional stakeholders, sharing their experiences, challenges, and contributions to the RUSTICA project. The event concluded with an open Q&A session, providing an opportunity for further discussion and clarification.

List of entities attending	- RUSTICA Partners.
	- Stakeholders:
	  - Alm
	  - Végétopôlis valley
	  - Suez organique
	  - Cycle farms
	  - Brangeon
	  - ALDEV
	  - Label verte
	  - Uplink
	  - Inrae
	  - Ac3a
	  - Terral
	  - Insitut agrop
	  - Rosé des champs
	  - Les vergers d'anjou
	  - Fleuron d'anjou
	  - Carpdl cdnn
	  - coopération Agricole ouest
	  - Florentaise
	  - ZEN

Main Conclusions	The event successfully welcomed regional stakeholders after a productive day-and-a-half partner meeting. Attendees included both stakeholders actively involved in RUSTICA regional workshops and new participants.

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	This gathering was a valuable opportunity to foster connections among RUSTICA partners and regional stakeholders, facilitating discussions on technologies, business models, fertiliser solutions, and ongoing field trials. Attendees gained insights into the roles of regional stakeholders within the bio-based fertiliser value chain and explored potential synergies. Furthermore, the event served to connect RUSTICA with other regional projects led by the Chamber of Agriculture. Notable examples include initiatives focused on the valorisation of urine in agriculture and other bio-based fertiliser developments involving key regional players. Overall, the session strengthened collaboration, knowledge exchange, and alignment on the development and implementation of sustainable fertiliser solutions in the region.
Link to website publication	https://rusticaproject.eu/rustica-project-meeting-held-in-angers/

2. Conclusions of RUSTICA cross-visits and cross-regional peer to peer-learning workshops

The cross-visits conducted as part of Task 2.5 provided invaluable insights into the implementation of bio-based fertiliser solutions and the challenges and opportunities associated with regional contexts. The following conclusions and lessons learned were identified:

1) **Importance of regional contexts**:
   Each region visited (Valle del Cauca, Flanders, Friuli-Venezia Giulia, Madrid, and Pays de la Loire) demonstrated unique challenges and opportunities.
   Infrastructure availability, local legislation, stakeholder readiness, and existing agricultural practices significantly influence the feasibility of implementing bio-based fertilisers. Tailored approaches are necessary to address these regional differences.

2) **Multi-Actor collaboration is crucial**:
   The success of the RUSTICA project is heavily dependent on effective collaboration among stakeholders, including farmers, researchers, technology providers, and policymakers.
   Cross-visits highlighted the importance of fostering active and continuous engagement to exchange knowledge, share best practices, and overcome barriers.

3) **Knowledge transfer and best practices**:
   The cross-visits facilitated knowledge transfer and the exchange of best practices.
   Practical demonstrations of composting processes, organic farming techniques, and innovative technologies underscored the potential for adapting European business models to other regions, such as Latin America.

4) **Stakeholder engagement and networking**:
   Effective stakeholder engagement during the cross-visits highlighted the importance of building strong networks. Events in Madrid and Pays de la Loire demonstrated how networking sessions can identify synergies, strengthen collaborations, and foster innovation

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